Citation:

Stunkard AJ, Berkowitz RI, Schoeller D, Maislin G, Stallings VA. Predictors of body size in the first 2 y of life: a high-risk study of human obesity. *Int J Obes Relat Metab Disord*. 2004 Apr;28(4):503-13.

PubMed ID: 14758342

Study Design:

Prospective longitudinal cohort study

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To compare the development of children of obese mothers with children of lean mothers during the first two years of life.

Inclusion Criteria:

Full term infants from white mothers who had a normal pregnancy, labor and delivery.

Mothers were 18 years or older with a pre-pregnancy Body Mass Index of greater than the 66th percentile or less than the 33rd percentile and no gestational diabetes.

Infants had no illness or disability.

Families expressed high degree of commitment to the study.

Exclusion Criteria:

Infants with a gestational age of less than 36 weeks or more than 42 weeks were excluded.

Description of Study Protocol:

Recruitment - Subjects were recruited from two newborn nurseries, seven obstetric practices, four pediatric practices and local referrals.

Design

Children born to obese mothers were considered "high risk" and those born to lean mothers were "low risk". Factors of age, height, weight and measures of socioeconomic status were obtained as

well as skinfold thickness, body fat, feeding mode, energy intake, nutritive sucking behavior, sleeping energy expenditure and total energy expenditure to correlate child's future weight status up to age two.

Blinding used

Food and formula records used to assess energy intake were assessed blindly.

Intervention (not applicable)

Statistical Analysis

Linear mixed effects regression models

Data Collection Summary:

Timing of Measurements

Pre-pregnancy body mass index calculated from reported height and weight.

Birth weight from hospital medical records

Weight, Skinfold thickness and body fat, 3, 6, 9, 12, 18, and 24 months of age

Energy intake via 3 day weighed food records during week after 3, 6, 9, 12, 18, and 24 months anthropometric assessment.

Nutritive sucking behavior assessed at one test meal during 3 month old visit

Sleeping energy expenditure (SEE) measured at 3 month old visit

Total energy expenditure (TEE) also measured at 3 month old visit with indirect calorimetry following for 7 days.

Dependent Variables

- Birth Weight
- Weight Gain
- Body Fatness
- Energy Expenditure
- Nutritive Sucking Behavior
- Feeding Mode
- Energy Intake

Independent Variables

Mother's pre-pregnancy BMI, age

Control Variables (not applicable)

Description of Actual Data Sample:

Initial N: 82 infants

Attrition (final N): 78 (40 high risk, 38 low risk) due to data not available on 1 high risk and 3 low risk in initial sample

Age: birth to 24 months

Ethnicity: white

Anthropometrics and other demographics:

	High Risk, n=40, (20 male: 20 female)	Low Risk, n=38, (19 male, 19 female)
Maternal BMI (kg/m^2)	32.1 $\pm$ 5.91	20.7 $\pm$ 2.82
Maternal age (y)	31.7 $\pm$ 4.7	33.7 $\pm$ 5
Paternal BMI (kg/m^2)	27.6 $\pm$ 4.6	25.4 $\pm$ 2.43
Infant Birth Weight (kg)	3.5 $\pm$ 0.5	3.5 $\pm$ 0.4
Breast fed	5	5
Formula fed	25	18
Mixed fed	10	15

Location: Philadelphia, PA, USA

Summary of Results:

Key Findings

- Birth weights of high and low risk infants were not significantly different.
- Parental BMI was not associated with child's body size during the first 2 years.
- The energy expenditure of the two risk groups was remarkably similar.
- Nutritive sucking behavior was significantly more agressive (sucks per minute) in high risk infants ($p>0.001$) yet there were not significant differences in total feeding time nor total calories consumed.
- Total energy expenditure at 3 months was positively correlated with weight at 3 months, 12 months and 24 months.
- Greater body size was associated with greater energy expenditure.
- When the large influence of prior body weight (R^2=76%) was controlled, three behavioral factors predicted weight acceleration: energy intake (R^2=4%), number of sucks at 3 months (R^2=4%) and family income (R^2=3%).
- The time lagged correlation between energy intake and weight gain indicates that the infants are eating larger amounts than necessary to meet current needs in order to meet future growth and development needs.

Table of regression analysis of potential predictors of weight gain between 3 and 24 months, (significant findings only)

	Estimate	SE	DF	t	P	R^2

Caloric intake prior interval	0.06421	0.02824	218	2.27	0.0239	0.039
Weight at prior visit	0.8194	0.04042	218	20.27	<0.0001	0.758
Number of sucks at 3 month	0.08680	0.02801	60	3.10	0.0030	0.040
Income<30k (socioeconomic)	0.2437	0.08428	60	2.89	0.0053	0.031

Author Conclusion:

Three behavioral factors predicted weight acceleration in children from birth to 2 years: energy intake, number of sucks at 3 months and family income with energy intake being the strongest predictor.

Reviewer Comments:

Authors acknowledge limitations of the study including small sample size and parental reporting of intake.

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions

1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes

2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	???
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	Yes
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	Yes
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	???
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	???
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	Yes
5.	**Was blinding used to prevent introduction of bias?**	Yes

5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	No
6.6.	Were extra or unplanned treatments described?	No
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	Yes
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	???

	7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**		Yes
	8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
	8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
	8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
	8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	No
	8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
	8.6.	Was clinical significance as well as statistical significance reported?	Yes
	8.7.	If negative findings, was a power calculation reported to address type 2 error?	No
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**		Yes
	9.1.	Is there a discussion of findings?	Yes
	9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**		Yes
	10.1.	Were sources of funding and investigators' affiliations described?	Yes
	10.2.	Was the study free from apparent conflict of interest?	Yes